MY TRIP TO CHINA

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ABSTRACT

This report is a result of the author's four-month visit to China under the exchange agreement between the Chinese Academy of Sciences and the National Research Council. It provides valuable and interesting insights into modern China under the open-door policy, in particular Chinese science and technology and the reform in R and D. Some general opinions, advice, and information on what can be expected by a visitor to China are also given.

RÉSUMÉ

Le présent rapport est l'aboutissement d'un séjour de quatre mois en Chine qu'a fait l'auteur aux termes d'une entente d'échange conclue entre l'Académie chinoise des sciences et le Conseil national de recherches du Canada. Il donne des aperçus précieux et fort intéressants de la Chine moderne en vertu du régime de la porte ouverte, et surtout de la science et la technologie chinoises et de la réforme au niveau de la R-D. Quelques opinions générales, conseils et renseignements sur ce à quoi peut s'attendre un visiteur en Chine sont également donnés.

MY TRIP TO CHINA

Stephen H.Y. HUNG

I. INTRODUCTION

From February 28 to July 4, 1985, I visited China under the exchange agreement signed in late 1983 between the National Research Council (NRC) and the Chinese Academy of Sciences (CAS). In the first two months, I stayed mostly in Beijing and had an office in the Institute of Computing Technology. During this period, I also visited several other institutes of the CAS and some universities.

Most of the second half of my stay was spent travelling to various places in China, as arranged by the CAS. This was possible because I was the first visitor from NRC to spend a longer term with them, and because of my Chinese background and my ability to speak Chinese. They wanted me to contact as many people as possible to introduce Canada and NRC, especially NRC. Not many people know what NRC is all about, and this is important for future exchanges. I went to 16 different cities, and visited branches and institutes of the CAS in those cities, as well as nine universities.

During all the time I was in China, there was ample opportunity for me to talk to many outstanding Chinese scientists at length. I also contacted many other people, such as administrators, young and old scientists, university professors, graduate students, and many of their families. I went to their homes for dinner, and went on picnics with them, too.

All these activities enabled me to get a good general view of research and development in China; furthermore, I was able to exchange points of view in depth with many researchers in the fields related to my work, and to discuss possible cooperation. I was also able to see many aspects of the impact of the open policy on the academic circle and on the daily life of the ordinary people. China, indeed, has become more open than before.

There was no pre-arranged activity in the proposal for this trip. The major goal of my visit was to understand and be understood by talking to Chinese scientists, joining their seminars, workshops, and lectures. This trip should be considered as quite successful in the sense of mutual understanding, establishing a communication line for further co-operation, and benefitting my future research work.

II. A GENERAL VIEW OF THE CHINESE ACADEMY OF SCIENCES

The CAS is our counterpart in China and has about the same mandate as ours. There are, however, two major differences between the CAS and NRC:

1. The size: the CAS has more than 80,000 people and approximately 120 institutes (equivalent to our divisions) across the country, covering almost every subject of science and engineering. We have only about 3000 people and 17 divisions.

2. They have graduate students and can offer graduate degrees. Their staff members usually do not have a teaching load, but can have graduate students work for them. They seem to get the best of both worlds, and this is definitely an advantage over the situation at NRC.

The CAS was founded on November 1, 1949, and rapidly expanded during the period 1956-1966. By 1965 the number of institutes had grown to 106 and the staff to over 22,000. However, during the 10-year domestic turmoil period, 1966-1976, the CAS was severely impaired. By 1973 only 53 institutes were left and the rank of research and technical personnel was reduced to 13,000. Very rapid growth took place in the period 1978 to 1985, when the CAS vigorously expanded to its present size.

Officially, the governing body of the CAS is the General Assembly of the CAS. It represents the highest policy-making organ of the Academy. It defines the general direction for research and development, elects the Presidium of the Academy, and examines and approves research programs of the Academy and review reports by the President.

The Presidium acts as the decision-making organ between sessions of the General Assembly. Members of the Presidium are elected by the General Assembly for four-year terms, and may be re-elected once. The Presidium in turn elects from among its own members three Executive Chairpersons, the President, and a number of Vice-Presidents. The President and Vice-Presidents hold a term of office tentatively fixed at two years and may be re-elected once.

In practice, however, not much is different from NRC. Even the roles of the President and the Executive Vice-President quite resemble ours. Some more points of interest are as follows:

1. The image problem: Most people in China do not know what the relationship is between the work of the CAS and their lives, or what impact the work of the CAS will have on the well-being of the economy of their country. All they know about the CAS is that a number of highly

trained, well-qualified academic persons work there, doing things that might contribute to understanding of highly academic problems. If the country is rich, of course, such work is both affordable and desirable. However, if the country is poor, such work might not be necessary.

2. Their structure is also quite similar to ours. The institutes form the basic units of the Academy and the primary organizations in which research is conducted. Each institute has staff numbering between 200 to 1600. Each institute is further divided into sections. Some institutes, such as the Institute of Automation in Beijing, are divided into groups (like the laboratories in the proposal for the re-organization of the Division of Electrical Engineering), and then further subdivided into small working units.

3. The Director and Deputy-Director of an institute are responsible for its professional and administrative work. However, they have one thing that we do not have, the Academic Committee of the institute. It is responsible for the academic affairs of the institute.

4. Slightly more than half of the 80,000 staff members of the CAS are scientific and technical personnel. The rest, of course, are considered as administrative staff. However, we should note that as a way of life in China, every organization looks after its members in almost every aspect of daily life. Consequently, much more administration is required. More than 90% of the members in the CAS live in the dormitories provided by the CAS. In some cases, how to distribute the dormitories fairly can become a real burden for the Director of an institute.

5. The major working force in the CAS are people in their forties. They are the last generation that was formally trained in universities before the cultural revolution, and they are still young enough to work and know the current state-of-the-art in their own fields.

   The people in their twenties are very promising. They are the cream of the crop. Most are graduate students of the CAS. They were selected from a very large number of candidates and then trained under the supervision of the best scholars in the CAS. Their ability in handling foreign languages is very good, too. Almost every one of them can have a chance to study outside of China. They are the hope of the future for the CAS.

   The worst of all are the people in their thirties. They are the lost generation almost completely ruined by the cultural revolution.

6. The administration is in the hands of the people in their fifties. We can single out certain points about this group at the CAS: (a) Most of

the Directors of the institutes are in this group. (b) Many of them studied in the Soviet Union in the 1950's. (c) Many outstanding researchers in China today are in this group.

Many of the people over sixty in the CAS studied in the West before they went back to China in the early 1950's. Most of them are in supervisory positions training the younger generation. Some of them may be still in administrative positions, but are gradually being replaced by younger persons, except for some exceptional ones.

7. Generally speaking, most of the research work in the CAS is trying to achieve in China what has already been done outside of China. That is, they are still in the catch-up stage. In a scale of 1 to 10, their work can be rated as about 5.

8. There may be some exceptions, but most of their equipment can only be considered as poor to fair. There is some highly sophisticated equipment, but the rate of utilization is very poor. Because such equipment is very expensive and mostly imported, it is carefully looked after, so very few people have access to it. Usually, only people from the particular group are allowed to use it. This is also true for imported scientific journals; their rate of utilization is lower than 5%.

9. They have a formal procedure to examine and to accept the result of a research project. The research team is required to present the result to a committee which is formed of persons in related fields from inside and outside of the CAS. The committee evaluates the result and determines whether it should be accepted and at what rating or be rejected as a failure. If the project is contracted from other Departments or is an important one, the Government has a more formal procedure on how to form the Committee and how to process the evaluation for acceptence.

III. REFORM IN RESEARCH AND DEVELOPMENT OF SCIENCE AND TECHNOLOGY

When I arrived in Beijing on Febuary 28, 1985, an important conference on the reform of research and development was just underway. Soon after that, the People's Congress was in session and passed important legislation about the reform of R and D in China. This influenced my visit in China to a very large extent.

The major goal of this reform is aimed at how to direct the R and D toward a closer link with the nation's economy; one of the major targets for this reform seems to be the CAS. All levels of administration in the CAS were preoccupied by this issue during the whole period of my visit. This

could be seen in the questions which they asked me and the kind of talks that they wanted me to give. Their major interest was not on the research work, but the organizational structure of NRC, the funding for R and D, and anything that related to the system of R and D in Canada and the West. On many occasions, I was able to get some of our points across, and there are items in the reform that will be very interesting to us. The following are some of them:

1. They emphasize that "Research must be closely linked with increasing the nation's economic growth and productivity. It should be aimed primarily at raising the technical level and efficiency of small and medium-sized enterprises." This sounds familiar, almost like a sentence from our annual report. However, this is a direct quotation from the speech given by the Minister of State Science and Technology Commission of China. They have almost the same concerns as us. They are very interested in our IRAP and PILP programs. This is exactly what they want to do.

2. The greatest impact felt by the CAS about this reform concerns the funding from the Government. So far, the CAS is funded almost entirely by the Government, except for some contract work from outside to generate extra income. Under this reform, the funding from the Government for most of the institutes will be phased out in three years. After that:

   a. the Government will only provide full funding for common facilities, such as libraries, etc.

   b. institutes which are doing only pure research, such as the Institute of Mathematics, will have to get their funding by applying for research grants in open competition. The Government will establish a science research foundation to handle the grants.

   c. all other institutes must find a way to support themselves. Each institute will be allowed to run like a business, geared toward market needs.

3. The life-time appointment for Directors and Deputy Directors has been changed to a three-year term appointment. Obviously, they wanted to review the performance of these people more frequently, and make it easier to remove the incompetent ones and the aged. By doing so, they have more chances to put younger and more able people in those positions. However, the problem is that not many people want to be in such positions. The major concern for the potential candidates is that if they are not reappointed after a three-year term, then their original research team will be in disarray or even may have disappeared. It

would be very difficult for them to start all over again. One compromise is that they can be the leader of a research team at the same time, thus retaining some connection with their own field.

4. The reform on salary: so far, a researcher's salary is almost entirely dependent on the number of years since graduation from university. They are trying to change that by dividing the salary into four parts: basic salary (about 40 yuans per month) (1 yuan ~ $0.50 Canadian); years of service (0.5 yuan per year monthly), the third part, the major one, which is determined by the job and the fourth part, the bonus, which depends on performance and could be up to 15% of the third part. For example: someone appointed to be a Director will get about 180 yuans per month for the third part, i.e., on top of the basic and the years of service; if you are hired by a project manager to do research in a project, then you will get your third part under the funds of the project, and the amount will be determined by your qualifications, experience, and the bargain between you and the manager. You are allowed to be involved in more than one project, as long as someone wants to hire you. However, if you are not hired, all you get will be the basic and the years of service; then you can do whatever you like or not do anything at all, but just learn to live on 50 yuans a month. You will not be laid off.

5. Since a full scale granting system is going to be established in China to handle all the research grants for pure research, they are very interested in our NSERC and the Science Foundation of the USA, especially the advantages and the disadvantages of those systems and how to handle grants fairly and effectively. They realize that the granting system will encourage competition and concentrate limited funding to support only the best projects. This will allow the Government to have some control over what kind of projects should be done and to steer the research work toward the desired direction.

   At the same time, they are also worried about side effects which may come out of such a system. Namely, many good scientists will spend a lot of time writing the proposals; people will be after fast results and less willing to do long term and more complex research; and some people may gang up and try to keep other people from getting funds. Especially, it will be hard for younger scientists to get a grant to start on their own.

   However, they did notice that the methods used by NSERC in handling grants did minimize some of the disadvantages, such as: to guarantee that beginners will get a fair grant to start on their own, grants are given out for longer terms, three to five years rather than one year.

6. One of the special problems caused by the reform is the "moonlighting" problem. Under the reform, researchers in the CAS will be allowed to work for extra income after hours; since their salary is low (about 100 to 125 yuans per month) compared to what one can earn by working for other commercial enterprises or industries after hours. The potential problem is that the researchers will neglect their regular work and concentrate on working for the extra income. They were interested in knowing that, in NRC, a not-so-official understanding about this matter is: Scientific staff members are allowed to work for extra income from outside. However, the time for and the income from the extra work should not be over 10% of that of the regular work; furthermore, the extra work should be in the related field and should not cause conflict of interest.

   They were also told that this is not much of a concern for us, since our income tax system automatically looks after this. Due to the much higher tax rate for the extra income, there are not many people wanting to work for the extra. However, in China, one only has to pay income tax if one's income is more than 800 yuans per month. One can earn about six times the regular salary and still not have to pay income tax.

7. They do realize the overall importance of the education system to the future of research and development in China. The major reforms in education includes: (a) up-grading the ministry of Education to the Education Commission (a super-ministry in Chinese Government); (b) increasing teachers' salaries by a large scale compared to the rest of the working people in China; (c) allowing different levels of Government to operate their own systems of higher education.

IV. RESEARCH AND DEVELOPMENT OF COMPUTER SCIENCE IN CHINA

The Institute of Computing Technology (ICT) of the CAS is the most important institution in the history of development of computer science in China. From this institute, we get a picture of the general situation about the development of computer science in China, in the past and now.

1. The ICT was founded in 1956 and most of its staff members were from the Institute of Mathematics and the Institute of Physics of the CAS. Today, the ICT has staff members numbering about 1600 and is the largest institute in the CAS. It is divided into about 20 sections which cover almost all aspects of computer science from hardware to software and applications. However, until 1980, the major activities were in the making of prototypes of computers that had been produced in the Soviet Union or in the West.

2. From 1956 to 1958, with the help of the Soviet Union, they built the first computer in China (model 103). In 1959, according to a blueprint provided by the Soviet Union, they built a large-scale computer (model 104). In 1961-1962, the 103 and 104 were formally produced in limited quantity: 38 of model 103 and 6 of model 104.

In 1964, they completed the first large-scale computer that was designed internally, model 119, which had 88K internal memory, magnetic drum, tape, and its own compiler. The 103, 104, and 119 all are made with vacuum tubes. The first transistor type computer, model 109B, that was designed and made by them was produced in 1964. An improved version, model 109C, was completed in 1967. Model 109C had 210K memory, compiler, assembler, and supervisory program. It can be considered as the representative of the second generation of computer in China.

The development of the third generation of computers built with integrated circuits (IC) was started in 1965. By 1971, they produced the first IC computer, model 111, that came with 280K memory and software package. In 1976, another IC computer, model 013, was completed. It has 768K main memory, disk, tape, compiler, and operating sysytem.

In July of 1975, they began building a superfast large-scale computer, a Cray-I type, and called it model 757; it was finally completed by 1983. Their major achievement in building the 757 is that almost 90% of the parts used to build this computer are made in China. The exception is the disk drivers, which are made in Bulgaria.

3. Until 1980, their major efforts were all in the area of hardware. They wanted to make every part and component by themselves. The software was always subordinate to the hardware and served only to meet the needs of the operation of the prototypes. There was almost no activity in applications. Therefore, their major achievement was the making of the prototypes, and nothing beyond that. Except, perhaps, for one or two models, they have never been put into mass or limited production. This is true not just for the ICT, it is also true for all the developments of computers in China.

4. The only models that had been produced in quantity are the DJS-100 series, the copies of NOVA series. Between 1973 and 1974, Qing Hua University (the M.I.T. of China) concentrated its effort to design the first computer in the 100 series, the model 130, and production was started in late 1974 by several manufacturers across China. Later, the 100 series were developed on the basis of model 130 in two directions, the lower level models 120, 110, and 112, and the higher level models 140 and 153. Between 1974 and 1984, the number of all 100 series

computers produced was about 840, and one-third of that are model 130. The model 130 is the most influential computer ever made in China.

5. They do make IC in China and are trying to make VLSI, too. However, the reliability is not satisfactory, and the cost of the product is still too high compared with the imported ones. Generally speaking, they like to use the imported ones whenever possible. According to my Chinese host, this actually gives Chinese scientists a big advantage over their Eastern European counterparts. Scientists in those countries are allowed to use only the IC produced by the Eastern European group or by the Soviet Union. They are eager to make some kind of connection with the Chinese to see if they can get some western IC through their Chinese colleagues.

6. They are beginning to realize the importance of software now. The Minister of State Science and Technology Commission said that one of their top priorities is to increase the use of computers, and their primary emphasis will be on developing software from the initial research through production and servicing of software programmes. They see the software as a key to get the most out of their limited quantity of computers.

   The Institute of Software was established early this year in the CAS. It consists of the most qualified software people in China, and certainly will be the leading centre for software R and D in China. Right now they have about 150 staff members, and will increase to about 600 by 1990.

   There also are many software centres within universities and other organizations around the nation. Notably, The Software Institute of The Wuhan University is a very active one. Besides the normal R and D activities, they are cooperating with some Japanese software companies, and actually accepting business from industries for doing programming work. They are also very anxious to find out about any possible cooperation that can be arranged with any organization in North America.

7. The application R and D has long been forgotten. Now they are looking for every way to catch up. They understand that, for China, the most important thing is not to build a first-class computer industry, but to use computers in every possible way to improve the productivity and efficiency of administration, communication, transportation, and all key sectors of the nation's economy.

   Their innovations are quite obviously shown in the area of application R and D. Due to the special circumstances, they have to solve some of their own problems with no help from the outside:

a. The processing of Chinese characters. Since the new technology, the output of Chinese characters is no longer a problem, but the input is still a topic of concern. There are more than 200 different methods in competition. They can be divided into two categories: (a) for the professional user, such as in the printing shop, newsroom, and typists. The method may require training to use, but must be efficient. (b) for all other users. Efficiency is not a concern, but little or no training should be required to use the method. There are about 10 or so methods that can be seen as the front runners, and the Government is still not in a hurry to standardize. Some terminals have five or six different ways to input Chinese characters, and the user can make his or her own choice.

The ICT developed a Chinese characters database in one board that can be plugged into any terminal with suitable interface. They also Chinese-characterized almost all software packages for the IBM PC computer.

b. Developing application programms that would do the job without using expensive, imported equipment. For example, in Beijing University, they developed a system for classifying and identifying fingerprints without any high resolution picture enhancing equipment as is commonly used in similar systems of the West. They eliminate the need for high quality and high resolution pictures by using computer graphic techniques to pick out, from an ordinary grade level picture, the global features that can be compared quantitatively by computer. This system can be run on a locally-made small computer and obtain reasonably good results. It costs less than 10% of a similar system in the West.

c. Their main effort is not to discover more highly sophisticated techniques, but to try to use any technique at hand for practical purposes. They simply use photographic colour enlargement techniques on LANDSAT or other aerial photos, and get many useful results to fulfil their practical needs. This is an important lesson for us to learn from them.

8. The biggest obstruction to increasing the use of computers is the illiteracy about computers among the general public, especially among the administrators. Most of them thought that a computer is just like a TV in that, once you plug it in, it will automatically do the things that it is told to do. The only difference is that you might have to learn the language understood by the computer in order to tell it what you want. While, in most cases, they are willing to spend a lot of money for the hardware, because it is easy to see that you are really getting

something, they usually are not willing to spend much money on software. Furthermore, they expect the computer to have the ability to solve the problems that are not understood or that they cannot solve themselves. Generally speaking, most of the people don't know what a computer is, how it works, and what its capabilities and limitations are. Once they realized the level of detail required to teach a computer, they lost all their zeal for the computer. They felt more comfortable sticking with the old way, and made no attempts for further improvement.

9. The CAS has branches in most of the major cities in China, and in almost every branch there is one institute in computer science. Each institute was established by people from ICT. The institutes in the branches work mostly on application problems and operate computing centres to provide services to the whole branch and to outside users. The computing centre, usually, is equipped with a small to medium-sized main frame computer, mostly older models of the IBM 370, which is a used machine from the rental market outside of China. They seem quite satisfied with the price and the reliability of these used IBM machines.

10. Due to restrictions on high tech trade with China, they can only get computers which are based on technology before 1978. Besides many personal computers (IBM PC dominates the market, and not many people know about McIntosh), most research institutes only have PDP11/33 or some equivalent. VAX11/750 are just beginning to come in. Orders for VAX11/780 have been taken and these are expect to come soon. For any model newer than that, the manufacturer cannot promise delivery because of uncertainty about obtaining the permit.

11. Artificial Intelligence (AI) is a popular field in China, too. There are several national conferences each year in this field. The ICT's involvement in AI is mainly in the areas of expert systems, general intelligent environments, and some work on computer vision. The Institute of Automation in Beijing is working on knowledge representation and robotics related fields, while the Institute of Psychology is involved in the work of learning from examples. The most experienced Institute in AI is the Shenyang Institute of Automation in northeastern China. They have been working on many areas of AI for some years. There also is much involvement at many universities. Similar to, however, the general state of computer research, most the research in AI in China is still in the catch-up stage, except, perhaps, for the work of a single-person team of Prof. Wu Wenjun of the Institute of System Science on the mechanization of theorem-proving in elementary geometry.

V. MY MAJOR ACTIVITIES

Before we drew up the proposal for this trip, we already knew that due to the lack of suitable equipment, the most that I could do in China was to talk to people, to join their seminars, workships, and lectures, to observe and try to understand what they are doing, and at the same time, let them know what is going on here. These were exactly the things I did there. During the four months, I was in 16 cities and visited more than 15 institutes of the CAS, nine universities, and two science associations. I was asked to give 11 talks, joined one conference, and took part in many official or unofficial discussions and lectures.

1. It was very difficult to make contact with people in the beginning, despite my Chinese background and my ability to speak Chinese. They put me alone in an office (the best one in ICT), and they don't have coffee-breaks or anything similar. Very few people in ICT would come to talk to me, except those who knew me before, because they seldom even talk to the people in other sections. After a week or so, once I did some reading and knew the basic information, then I started to put myself into action by

   a. attending their weekly educational lecture. I got a chance to know the speakers and their fields, as well as the audiences and their interests. I tried to talk to them, and invited them to my office or where I was living for further talking at length. Eventually, it turned out to be the most rewarding experience.

   b. inviting the administrators, such as the Director and Deputy Directors, to my place after working hours. Because they are so busy during the day time, it is impossible to discuss with them all the problems I wanted to talk about, and to make the necessary arrangements for the best use of my time in China. Once they came to my place, we had three or four hours to talk about everything in detail and in a much more relaxed mood. The schedule for my whole visit was wrapped up in several such lovely evening talks. The communication lines that were built up between us will certainly benefit the future cooperation.

   c. using all my old connections. I tried to contact the people I knew before I went to China. Some of them had been working in NRC for some time, some had visited NRC before, and some were my classmates in high school. Through them I got access to many other research institutes and universities.

   Once I made headway and the people knew there was a person visiting from Canada, I became very busy talking, discussing,

visiting, and giving lectures. My time was filled to such an extent that I only got a chance to visit the Great Wall three days before I was going to leave China.

2. After spending several thousand dollars, flying nine thousand miles, leaving my family, and going to an unfamiliar place with poorer equipment, there was no point in doing the same work that can be done in Canada. In order to get the best out of the four-month visit to China, what I decided to do are things that will benefit us, but cannot be done in Canada. One of those things that was most interesting to me and would be a rare opportunity for anybody was the opportunity to talk to many top scholars in China. Many of them are in the rank equivalent to our Fellow of the Royal Society of Canada in their own field in China. Due to our similar backgrounds (all of them have strong mathemetical backgrounds) and common interest (computer science, especially, AI), all those talks were really in depth, at length, and very enjoyable for both of us. We shared experiences and concerns, and exchanged points of view. It cleaned up ambiguities in my mind as well as reinforced many of my strong beliefs. Some of their points of view are especially valuable to us, because we cannot get them from anybody else. All these are a great help to me in determining the direction and planning my research work for the future.

3. I was asked to give 11 talks on different occasions. One was in a conference, two were for science associations, four were in universities, and the rest were for the research institutes (the list is attached as an Appendix). The majority of those talks falls under two main topics: (a) an introduction to NRC and the R and D system in Canada; (b) the current research work on computer technology in the West and in NRC. Most of the talks were about three hours long, a normal length in China. The audience was mostly scientific staff and graduate students. Because I gave all my talks in Chinese, many of the administrative staff also attended, especially when I was presenting the first topic. This was also due to the special interest generated by the reform of R and D in China; they were eager to know more about how those things that are related to their reform are handled in other countries.

The talks I gave for the Science Associations, especially in those cities that were not visited by many foreign scientists, had their special importance. They were presented to a wider audience, and might be the only first-hand information for a long time available to many people. They are so eager to know more and there is such a lack of information, any information at all will have great impact on them.

4. During the visits to the institutes and universities, usually a discussion with a smaller group of staff members and graduate students would be arranged. It was a better occasion for talking about some related problems in depth, or directly responding to questions that they were especially interested in. At the same time, I was able to find out more about what was going on and what was in their minds. The younger people usually asked more questions and brought out more interesting points.

There were also many occasions when a group of younger staff members and graduate students gathered at my place or at a picnic, and talked informally. We talked freely about almost everything. I was able to get across many points on how the R and D is being done here as well as how our country is being run. This was an important part of my mandate for visiting there.

VI. GENERAL OPINIONS AND SUGGESTIONS FOR FUTURE EXCHANGES

1. In Beijing, I stayed at the Friendship Hotel. It is a big compound in the west suburb of Beijing, and very near the main campus, Zhongguancun, of the CAS. It takes 5 minutes to drive to the ICT, but about 30 minutes, a 10 kilometre ride, to the city centre. This big compound was originally built for hosting Russian experts in the early 1950's and was changed to a hotel in the early 1960's after the Russians had gone home. The CAS has subsidized one of the buildings, Building No. 5, in the hotel, and the guests of the CAS stay in that building. Each unit in that building consists of a living room, a bedroom with two single beds, and a bath room. Its inside is old but kept reasonably clean. The central heating system operates in the winter, and there is a portable air-conditioner in each room for the summer.

2. You can pick up the newspapers (People's Daily in Chinese and China Daily in English) free of charge each day at the front counter. There is a 19-inch Panasonic colour TV in each unit, but it would be of no use if you don't know Chinese. There are four channels in Beijing, and running about four hours per day, usually from 6 to 10 PM. On Sundays, there are some daytime programs. A shortwave radio is a necessity for someone who doesn't want to lose contact with the outside world. You can freely listen to any broadcast from any place without jamming. BBC, The Voice of America, and Radio Australia (unfortunately, not Radio Canada) all have quite a big audience in China. Many Chinese learn their English through listening to those broadcasts.

3. The food is provided by the restaurants inside the compound. There is more than one restaurant; the guests living in the No. 5 building are

assigned to the nearby Northeast Restaurant. Upon giving your room number to the waiter or waitress, you will be provided with the food according to a set menu determined by the restaurant from day to day. While there is a choice of Chinese or western style cooking for breakfast, they only serve Chinese food for lunch and supper. The set menu usually consists of four or five dishes, rice, soup, and the drink of your choice (beer, mineral water, or soft drink). This is also what you will get when you travel to other cities and stay at the guesthouse or hotel. However, I was able to convince them that because I was going to be there for four months, I could not eat the set menu food for such a long period. They agreed to pay me the food allowance, about 25 yuans per day, and gave me a special privilege card that would allow me to use the local money (all foreigners are expected to pay in Foreign Exchange Certificates), except on trips. So I could eat where I liked and order what I wanted. I suggest that exchange scientists can ask for this privilege if they are going to stay for a period longer than a month and would like to have some western food once in a while. They would not give this to anyone who will stay there for less than a month.

4. The best time to visit China is September and October. The fall is the most beautiful season in China. Its beauty is not restricted to the visual impact of the autumn leaves, it includes the temperature, humidity, wind speed, and everything related to comfort, plus sunshine and blue sky for most of the time. The only shortcoming of the autumn is that if you have a very strong Chinese cultural background, then you will always feel a little sad, because this is a season that lets you think about the past and you should be home with the family, just like at Thanksgiving here.

   The summer is too hot and humid in most parts of China. Don't count on the air-conditioning, for in most working places, there would not be air-conditioning except perhaps in the computer room. In the winter, the outside temperature is not bad; however, due to inadequate heating, you will feel much colder than here. A large part of China, south of the Yangtze River, has no heating at all (but not the foreign guests' hotels). The spring is warm, but wet. In Beijing, the spring is short, jumping from winter to summer in two or three weeks in May. During March and April, it is very windy and dusty. Three cities along the Yangtze River, namely, Nanjing, Wuhan, and Chongqing, are famous for their summer heat and are called the Three Ovens. Try to avoid being there in the summer whenever possible.

5. While the postal service as well as the telegraph service are excellent in China, the telephone service is terrible. Due to the lack of lines

and outdated equipment, the chance for a local phone call to get through is less than 50%. Even if you get connected, it does not mean you can communicate; the phone line usually is noisy and you have to hang up and try again. To make a long distance call to another city in China is even more difficult; you would be much better off using a telegram. However, it is much easier to phone Canada than to make a local call, because of the use of satellite. Telex is not popular; as far as I know, the CAS has only one telex terminal at the Headquarters. In case you need to communicate with NRC, you can go to the Canadian Embassy in Beijing; they will be glad to help you out.

6. Transportation is another bottleneck in China. The railway is by far the most important method of transportation, followed by inland shipping. Highways and airlines have been improved significantly, but still have a long way to go to meet the needs. The poor communication lines add an enormous burden to the already heavily overcrowded transportation systems. Firstly, many business problems cannot be solved by phone and the people involved have to talk face to face, thus creating a lot of otherwise unnecessary business trips. Secondly, the booking and ticketing systems, without modern telephone lines, are so primitive that you can only book the seat and get the ticket at the departure point, and usually you have to be there in person. It is not unusual for the people on the ground to be unable to get tickets, while the airplane up in the sky has a lot of empty seats. The best you can do is plan your trip as early as possible; the CAS has a whole system across the country to book and get tickets for you at all the connection points. Nevertheless, it does not mean that you will be on schedule. The situation for hotels is quite similar.

7. You don't need to be an expert to see that, in China, the highest priority for the use of computers should belong to the communication and transportation systems, especially the former one. They are where the greatest improvement is possible, with almost everything else depending on them. The post office should have the lowest priority because not much improvement can be obtained by introducing automation. It will only be meaningful if the labour cost is higher than the cost of automation.

8. Due to the insufficient public transportation in cities, the CAS provides a guest with a car with driver. It may be a car from the institute or a taxi rented at a daily rate. It is quite convenient for going to and from work, or for an occasional trip to the city centre. The only problem is the speed; since there are a lot of bicycles on the road, the car can only go about 40 kilometre per hour at the best. A 10 kilometre trip will take about 30 minutes; you can schedule your time

accordingly. However, in the evening, you should not come back to your accommodation too late, since the driver has to return the car to the garage and then take public transportation home. The best way to visit friends in the evening is by taking a bicycle. In China, a bicycle provides the same mobility as a car in North America. However, taking a bicycle in daytime is a bit dangerous; there are far too many bicycles and cars on the road. In Beijing, there is at least one cyclist killed by a car each day.

9. The biggest change you can see in Chinese people's life is in their dress, especially among the younger people, whose dress is not much different from that of the young people here. While blue jeans are very popular among the young people, western style suits are becoming more popular for all ages.

   The housing and general hygienic conditions have been improved in recent years, but are still far from satisfactory. Usually, the washroom is a dark spot. As a North American, you may be a bit uneasy about the condition of a public washroom, but the cleanliness of washrooms for foreign guests can be considered as acceptable.

   The lack of maintenance is really the biggest shortcoming in considering the housing in China. Many dormitories and public buildings are only about 5 or 6 years old, but look more like 20 years old inside and out. It is not uncommon that a newly built hotel, after one or two years, will appear to be falling apart. The weakest spot seems always to be the bathroom.

10. It is not easy to get service or spare parts in China, especially for imported goods, so most Chinese people prefer the old model with proven reliability, rather than the new improved version. Any goods that are intended for sale in China should have a record of proven reliability, and provide sufficient training and documents, so that the Chinese will be able to do the servicing. Sony is very successful at that, so they almost dominate the market of equipment for TV stations in China. West Germany also gives the Chinese a very good impression; they sell not just the equipment but provide the technology, too. Canada is not rated very high at that. Most Canadian sales to China are wheat, with which there is not much of a problem for service or maintenance. However, Dipix has sold about 20 of their image processing systems to China, and 40% of their business deals with China, but they do not have an office in China. The general complaint among the users is unsatisfactory maintenance and warranty service, and lack of training and documents to suit the special environment in China.

11. Most educated people in China do have some understanding about what is happening in the West. However, while they seem informed somewhat on our industrial, scientific, and technological developments, they are badly informed on how our country is being run. They were quite surprised to know that we have such a good medicare system which so equally applies to everybody. It is also difficult for them to understand that, in Canada, when you graduate from a university, the Government neither assigns you to a job nor tells you where to live. The most difficult thing for them to comprehend is, if their Government looks after so many things and there are still so many problems, how, in Canada, when our Government has not been involved in all those things, can this country run in so orderly a fashion.

    It is not an easy task to let them know how our country is run, and how things get done here. However, this is such an important part in the building up of mutual understanding, an integral part of this exchange, that we must do our best to achieve as much as possible. The scientists who are going to participate in exchanges should prepare themselves to know not only their own work or the activities of their own section or division, but also the activities of other divisions and the whole of NRC. It would be useful to pay some attention to how our system works, and how it affects our daily lives. In China, they see you not only as an exchange scientist, but also as a delegate of Canada. What you do and what you say there will be very important material for them to build an image of Canada in their minds.

12. It is worthwhile to look closely at some institutes of the CAS which are the leaders in their own field in China, and from them we can see the state of art of China in those fields:

    a. Shanghai Institute of Biochemistry. This is the Institute where they successfully produced the chemical synthesis of crystalline bovine insulin. This year, they set up a laboratory in Shanghai, with West Germany provided equipment, for international cooperation on biochemical research. This newly equipped laboratory should be good enough to host scientists from around the world to do research there.

    b. Shenyang Institute of Automation. This is the most experienced institute in China in the fields of machine intelligence, image processing, and robotics. It is located in Northeastern China; nearby, the Jilin University is also quite strong in similar fields.

    c. Changchun Institute of Optics and Fine Mechanics. It is also located in Northeastern China, and is the parent of all similar

institutes all over China. One of those institutes is the Shanghai Institute of Optics and Fine Mechanics, an institute that is devoted wholly to laser research. It is also worth a visit by our people in the same field.

VII. CONCLUSIONS

Due to the lack of equipment, the current level of R and D there, and the length of time allowed for a stay under the current agreement, we cannot expect much real research work to be done by a visitor to China now and in the near future. The reasonable things that we can expect to be achieved by this exchange agreement are mutual understanding, the establishing of communication between scientists at the personal level and, hopefully, trying to start some kind of cooperation. Certainly, under the current circumstances, the exchange agreement will benefit them much more than us. Nevertheless, this is an important stage through which we must pass to ensure continued cooperation between our two countries.

The CAS is anxious to upgrade the exchange for a longer term visit (one year or longer). They felt this is necessary for the exchanging scientists to get something done during their exchange periods. While this might be true for Chinese scientists coming here, it would not do much good for us at this time. At present, we will not achieve much beyond the scope mentioned above by simply staying longer. Furthermore, if someone is allowed to stay longer, fewer people will be able to participate in this exchange under the present budget. It certainly will not help either of us to gain more understanding of each other. In the long run, it will be better off for both of us to establish more mutual understanding and communication lines as a solid foundation for future exchange, rather than to try to get something done in a hurry at the present time, unless there is extra money to do so.

The best length of visiting time is two to three months. One month or less will be good only for sight-seeing; it is not enough time to make the personal contacts necessary to gain the kind of mutual understanding that will serve the purpose.

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APPENDIX: THE TALKS PRESENTED IN CHINA

1. "An Introduction to NRC and the R and D in Canada." The Institute of Computing Technology, The CAS, Beijing, March 28, 1985.

2. "The Current Computer Technology and Its Impact to Our Life in North America." The Institute of Mechanical Science, Ministry of Mechanical Engineering, Beijing, April 9, 1985.

3. "The R and D of Science and Technology in Canada." Chengdu Institute of Computer Application, The CAS, Chengdu, May 7, 1985.

4. "My Impression on The R and D of AI in China." (Invited) The Sixth Conference on Artificial Intelligence, Southwestern Jiao-Tong University, Sichuan Province, May 10, 1985.

5. "The Current Research of Computer Technology in NRC." Department of Automation, Qing Hua University, Beijing, May 21, 1985.

6. "An Introduction to NRC and Its Current Research on Computer Technology." Purple Mountain Observatory, The CAS, Nanjing, May 29, 1985.

7. "The NRC and The System of R and D in Canada." Shanghai Centre For Scientific and Technological Exchange With Foreign Countries, Shanghai, June 4, 1985.

8. "The Current Research of Computer Technology in NRC." Department of Computer Science, Fudan University, Shanghai, June 4, 1985.

9. "An Introduction to NRC and Canadian Universities." Department of Electronics, Zhongshan University, Guangzhou, June 14, 1985.

10. "The Capability and Limitation of a Computer and When and How to Use It." The Extension University, Second Department of Light Industry, Guangzhou, June 15, 1985.

11. "The Current R and D of Computer Technology and Its Applications in North America." Kunming Science Association, Kunming, Yunnan Province, June 19, 1985.